



News from NSF

Denise Caldwell

Division Director
Division of Physics

With Input from Program Directors: Jim Shank; Brian Meadows;
Jean Cottam; Jim Whitmore; Keith Dienes; Saul Gonzalez;
Bogdan Mihaila



Stardate 14 September 2015

The merger of two black holes and the birth of a new one.

Event GW150914

Original black holes:

29 and 36 solar masses (M_{\odot}).

Final black hole:

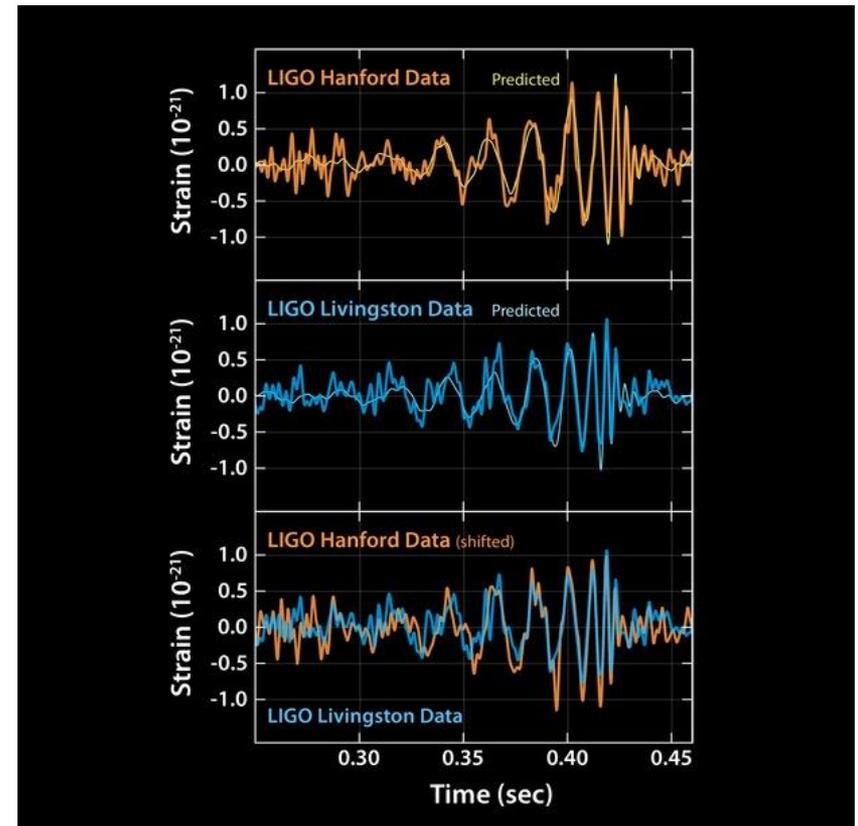
$62 M_{\odot}$ with dimensionless spin 0.67

Energy emitted: $3 M_{\odot}$

Power emitted: $200 M_{\odot}/s$

(140 billion trillion times that of the Sun)

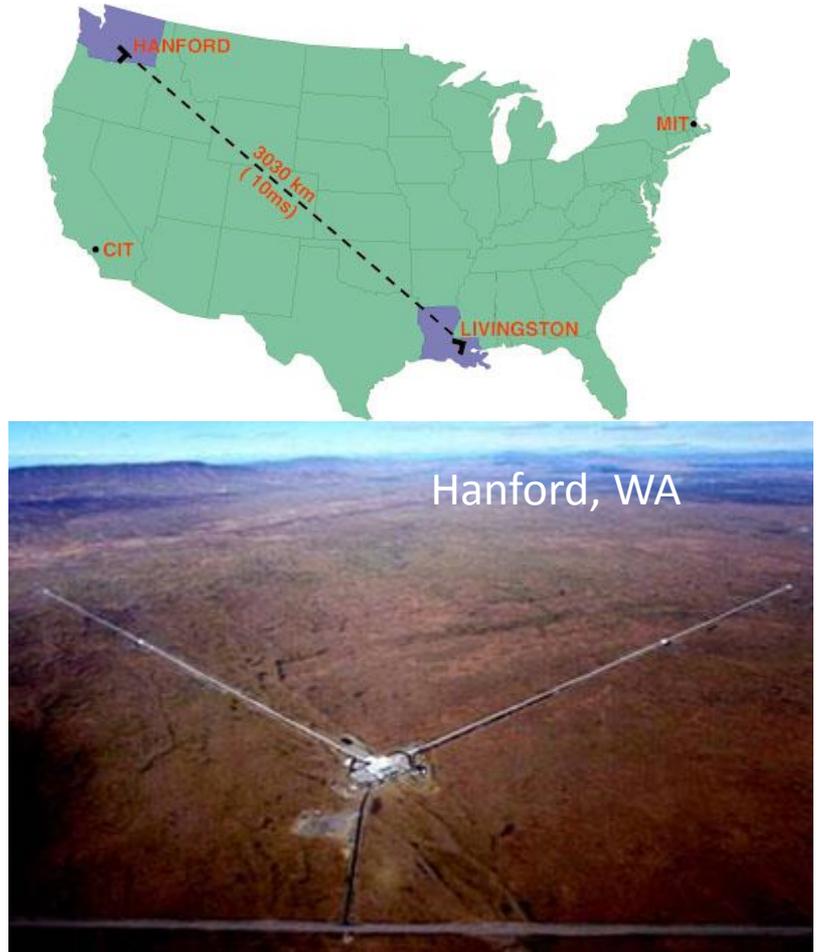
Most powerful explosion recorded not including the Big Bang!





First Direct Detection of Gravitational Waves

NSF's **L**aser **I**nterferometer **G**ravitational Wave **O**bservatory





View from MPS

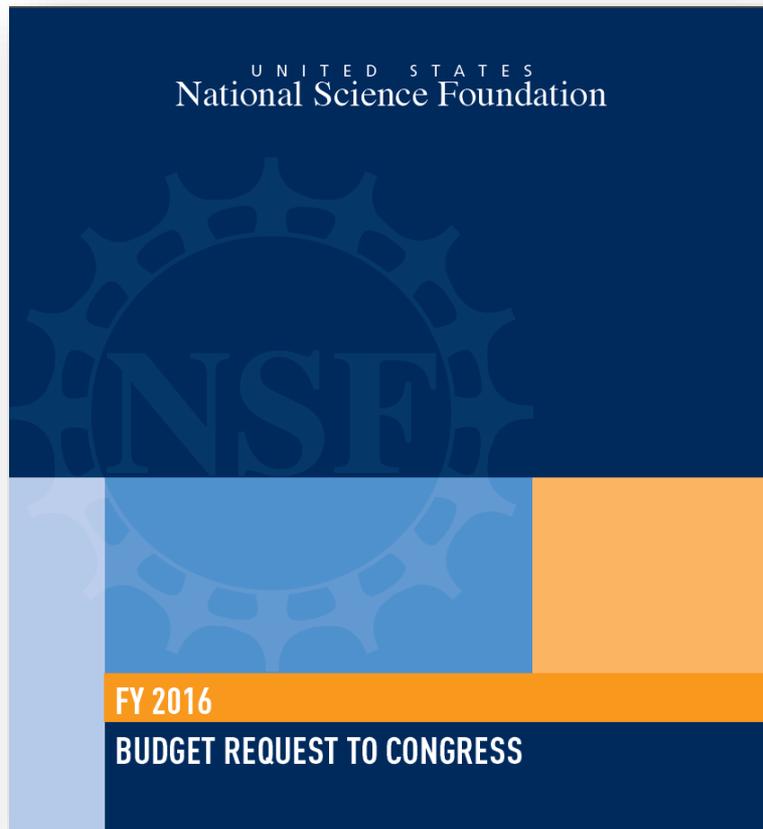
Taken from Budget Presentation by

Fleming Crim, AD, MPS

On February 9, 2016



FY 2016 Omnibus Bill



	FY 2015	FY 2016 (request)	
NSF	\$ 7344 M	\$ 7724 M	5.2%
R&RA	\$ 5934 M	\$ 6186 M	4.2%

FY 2016 (estimate)		
NSF	\$ 7463 M	1.6%
R&RA	\$ 6034 M	1.7%



NSF R&RA Funding by Directorate

R&RA Funding

(Dollars in Millions)

	FY 2015 Actual	FY 2016 Estimate	FY 2017 Request	Change over FY 2016 Estimate	
				Amount	Percent
Biological Sciences	\$736.19	\$744.17	\$790.52	\$46.35	6.2%
Computer & Information Science & Engineering	932.98	935.82	994.80	58.98	6.3%
Engineering	923.53	916.19	1,002.73	86.54	9.4%
Geosciences	1,319.04	1,318.54	1,398.83	80.30	6.1%
Mathematical & Physical Sciences	1,376.32	1,349.15	1,436.45	87.30	6.5%
Social, Behavioral & Economic Sciences	276.19	272.20	288.77	16.57	6.1%
Office of International Science and Engineering	48.46	49.10	52.05	2.95	6.0%
Integrative Activities	427.46	447.06	459.86	12.80	2.9%
U.S. Arctic Research Commission	1.41	1.43	1.43	-	-
Total, R&RA	\$6,041.57	\$6,033.65	\$6,425.44	\$391.79	6.5%

Totals may not add due to rounding.



MPS Budgets by Divisions

FY 2014
\$ 1300 M

3.5% →

FY 2015
\$ 1345 M

0.3% →

FY 2016
\$ 1349 M
(estimate)

MPS Budget

\$ 300 M

\$ 200 M

\$ 100 M

\$ 0 M

AST

CHE

DMR

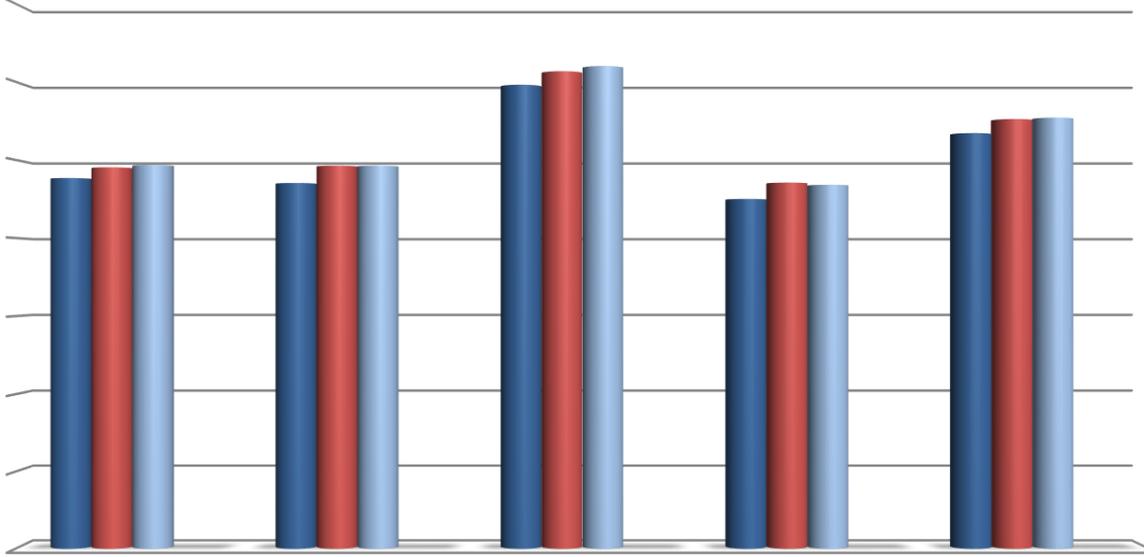
DMS

PHY

FY 2014

FY 2015

FY 2016 (estimate)

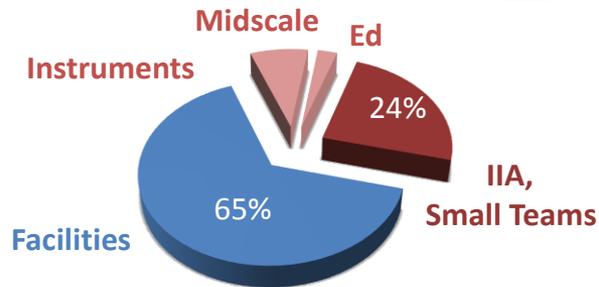
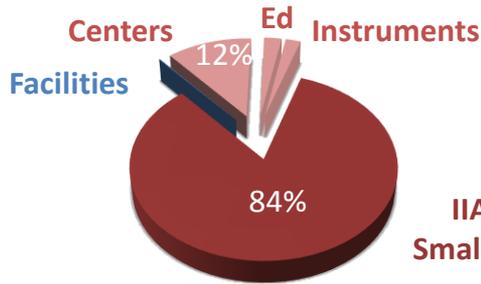




Mathematical and Physical Sciences (MPS)

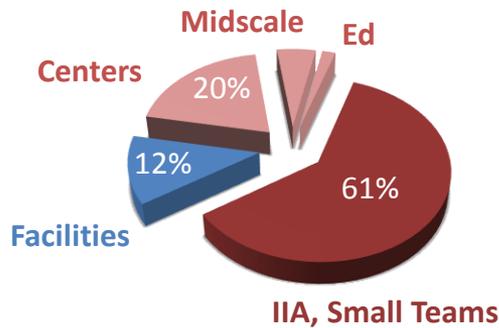
Astronomical Sciences (AST)

\$ 247 M



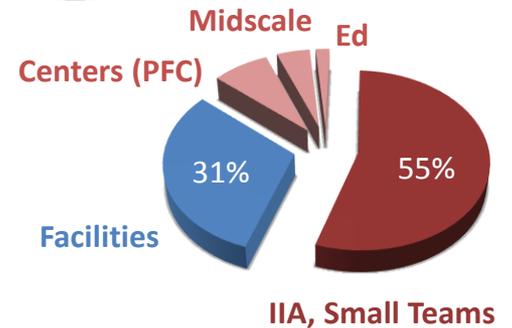
Chemistry (CHE)

\$ 246 M



Materials Research (DMR)

\$ 310 M



Mathematical Sciences (DMS)

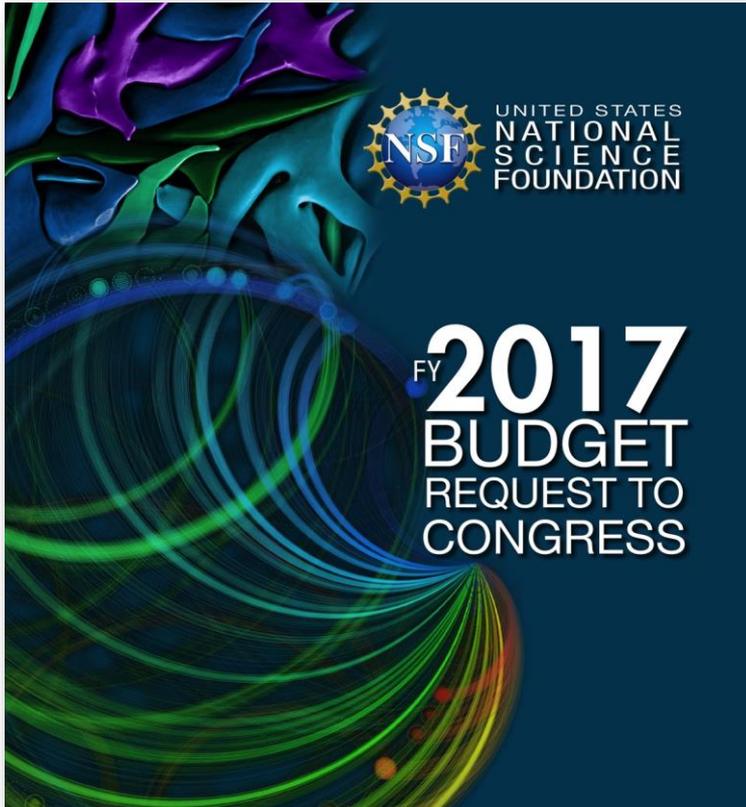
\$ 234 M

Physics (PHY)

\$ 277 M



The President's Request to Congress



	FY 2016 (Estimate)	FY 2017 (Total Request)	
NSF	\$ 7463 M	\$ 7964 M	6.7%
R&RA	\$ 6034 M	\$ 6425 M	6.5%
Two Components to R&RA			
Discretionary	\$ 6034 M	\$ 6079 M	0.8%
Mandatory*	--	\$ 346 M	--
Total	\$ 6034 M	\$ 6425 M	6.5%

*Direct spending (not subject to discretionary caps)
One-year duration



FY 2017 Request by Appropriation

	FY 2016 Estimate	FY 2017 Discretionary		FY 2017 Mandatory	FY 2017 Total	
Research & Related Activities	\$ 6034	\$ 6079	0.8%	\$ 346	\$ 6425	6.5%
Education & Human Resources	880	899	2.1%	54	953	8.3%
Major Res Equip & Facilities Const.	200	193	-3.6%		193	-3.6%
Agency Operations & Award Mgmt.	330	373	13%		373	13%
National Science Board	4	4			4	
Office of the Inspector General	15	15			15	
Total NSF	\$ 7463	\$ 7564	1.3%	\$ 400	\$ 7964	6.7%

Totals may not add because of rounding (\$ in millions)



MPS FY 2017 Request by Division

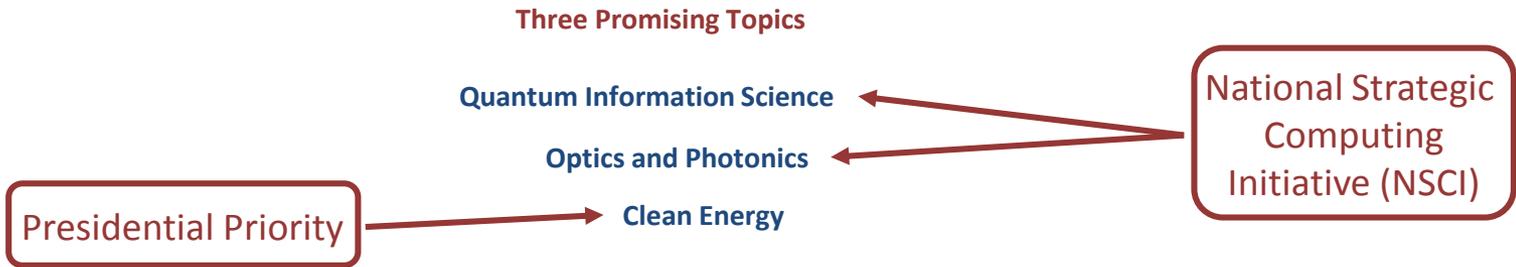
	FY 2016 Estimate	FY 2017 Discretionary		FY 2017 Mandatory	FY 2017 Total	
Astronomical Sciences (AST)	\$ 246.73	\$ 247.73	0.4%	\$ 14.88	\$ 262.61	6.4%
Chemistry (CHE)	246.31	247.31	0.4%	14.85	262.16	6.5%
Materials Research (DMR)	310.03	311.03	0.3%	18.68	329.71	6.3%
Mathematical Sciences (DMS)	234.05	235.05	0.4%	14.12	249.17	6.5%
Physics (PHY)	277.03	278.53	0.5%	16.73	295.26	6.6%
Multidisciplinary Activities (OMA)	35.00	35.41	1.2%	2.13	37.54	7.3%
Total MPS	\$ 1349.15	\$ 1355.06	0.4%	\$ 81.39	\$ 1436.45	6.5%

Totals may not add because of rounding (\$ in millions)



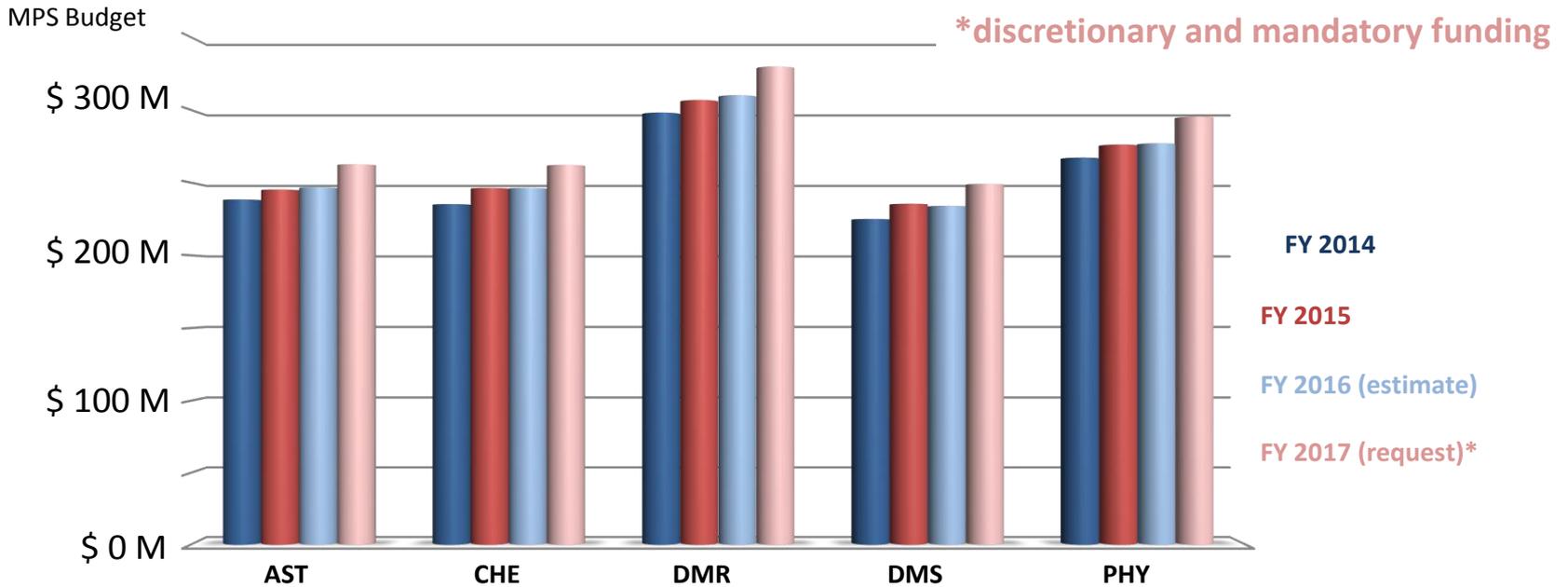
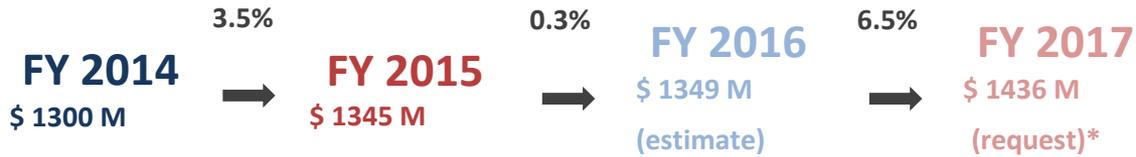
Mandatory Spending Category \$ 81 M

- Individual investigators
- Early career investigators
- Unsolicited proposals (“core”)
- Computation and data



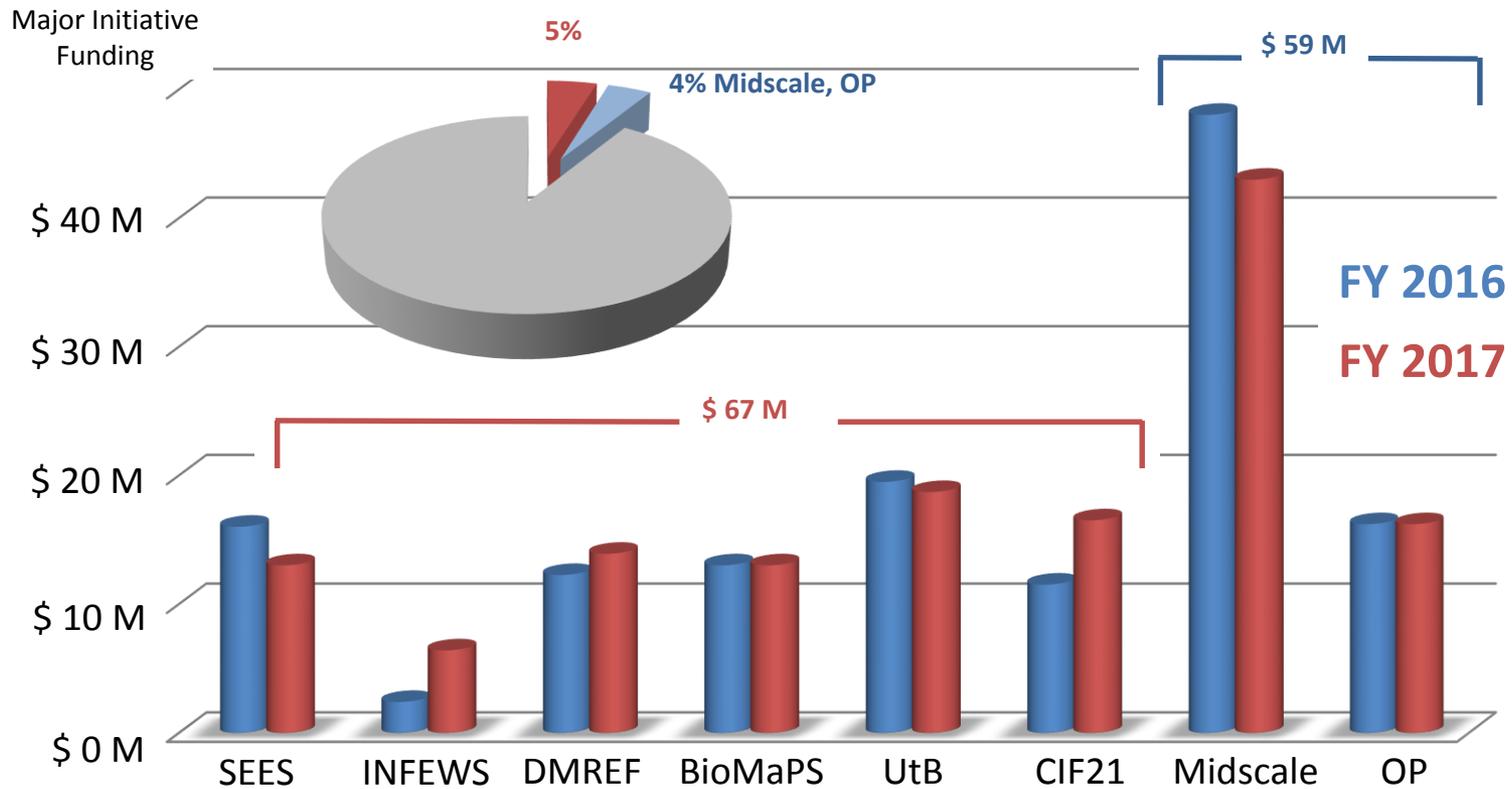


MPS Budgets by Divisions





Selected Investments in Initiatives





MPS Participation in NSF-Wide Initiatives

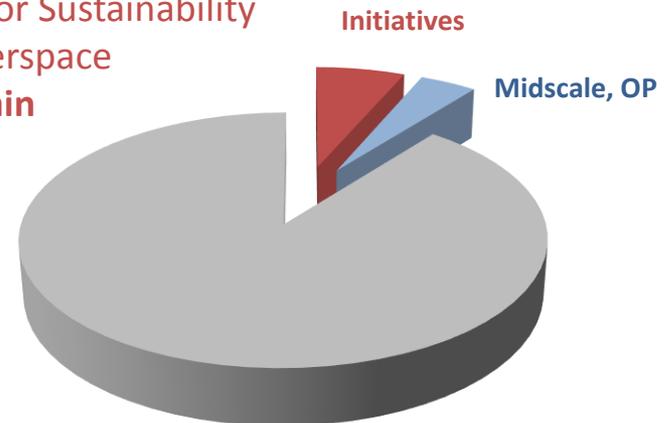
- Biology, Mathematical, and Physical Sciences Interface
 - Cyberinfrastructure Framework for the 21st Century
- Designing Materials to Revolutionize and Engineer our Future
 - Innovation Corps
 - **INCLUDES**
- **Innovations at the Nexus of Food, Energy, and Water Systems**
 - National Science Foundation Research Traineeship
 - **Risk and Resilience**
- Science, Engineering, and Education for Sustainability
 - Secure and Trustworthy Cyberspace
 - **Understanding the Brain**

BioMaPS, CIF21, DMREF, I-Corps, INCLUDES,
INFEWS, NRT, R&R, SEES, SaTC, UtB

\$ 92.5 M



6.4% of MPS Request





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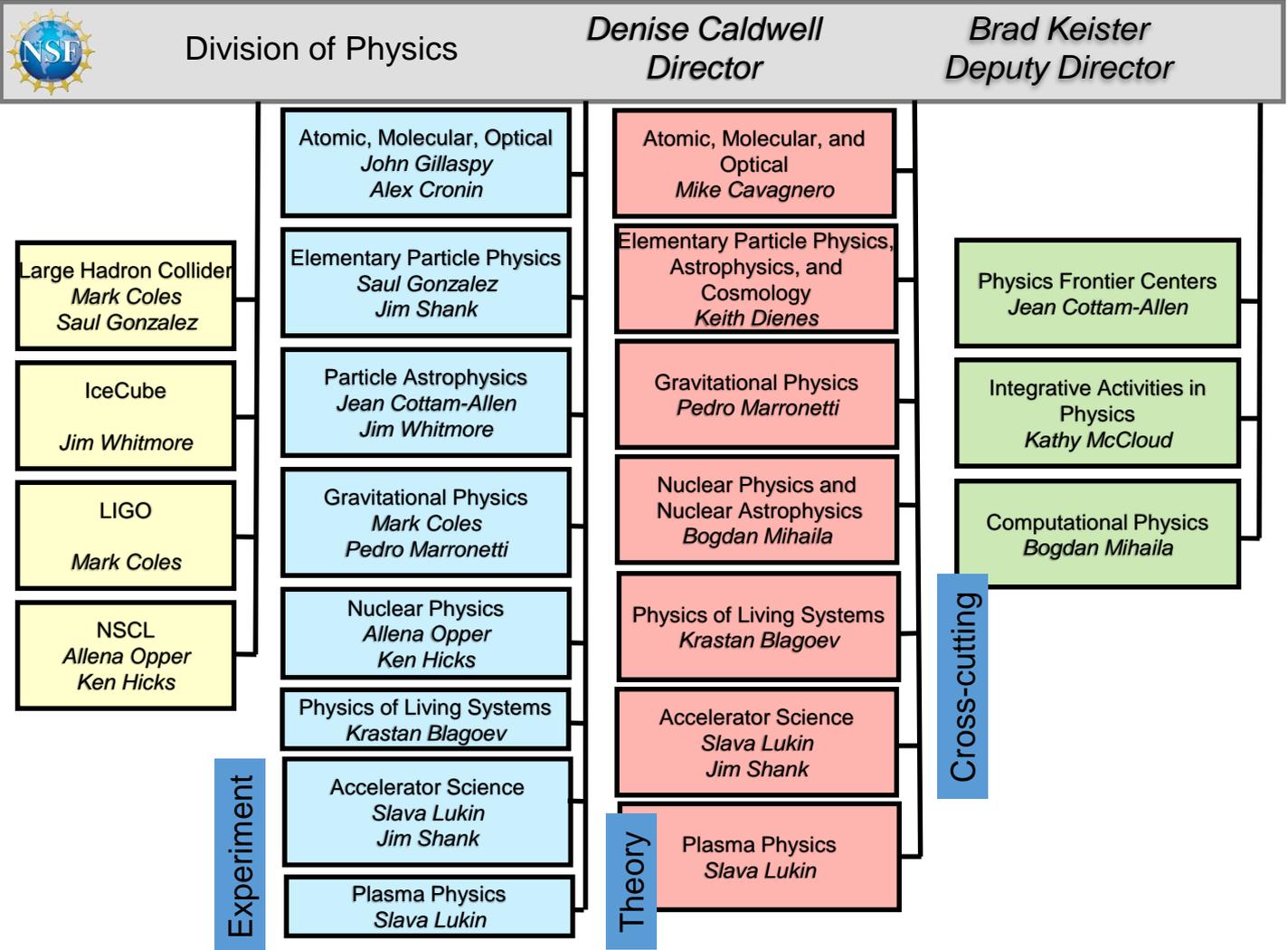
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DIVISION OF HUMAN RESOURCE MANAGEMENT (DHM)

Julie Bentley, Division Director

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THE CORE – THE HEART OF WHAT WE DO

Major Sub-Areas of Physics (Experiment and Theory)

Gravitational Physics

Atomic, Molecular, and Optical Physics (Includes QIS)

Nuclear Physics

Particle Physics (EPP and PA) (~25% of total program funding)

Physics of Living Systems

Plasma Physics (NSF/DOE Partnership in Basic Plasma Science
and Engineering)

Accelerator Science

(Note that Condensed Matter Physics is NOT included)



Cross-Cutting Programs

Computational Physics – Computational Needs Across all Disciplines

Integrative Activities in Physics - PHY Component of REU Site Program; Activities in Physics Education and Outreach (PhysTech, QuarkNet, I2U2, LIGO Science Center); Broadening Participation Co-Funding Activities

Physics Frontiers Centers - Currently fund ten centers (KITP, KICP, JILA, CUA, CTBP, JINA, JQI, CPLC, IQIM, Nanograv); Broad and often Highly Multidisciplinary (with co-funding from AST, CHE, DMR, MCB, CCF, PLR)

Major Facilities – NSCL, LIGO, IceCube (with Polar Programs), ATLAS and CMS Detectors at LHC (with DOE)



Physics Division Portfolio

The portfolio of awards made through the Physics Division has as primary goal “to promote the progress of science”, as expressed in the NSF act. Awards in the portfolio support the research needed to address a scientific question that is at the frontier of knowledge as it is currently known, while at the same time extending and redefining that frontier. Inherent in the implementation of this portfolio, which includes significant support for students and junior scientists, is the preparation of the next generation of the advanced high tech workforce and the development of innovative new technologies that arise in the quest to answer some of the hardest questions that Nature can pose.



Questions Cut Across Disciplinary Programs

Controlling the Quantum World: Optical Physics;
Quantum Information Science

Complex Systems and Collective Behavior: Physics of Living Systems; Atomic
and Molecular Dynamics; Nuclear Physics; Plasma Physics

Neutrinos and Beyond the Higgs: Particle Astrophysics; Gravitational Physics;
Nuclear Physics; Precision Measurements; Elementary Particle Physics

Origin and Structure of the Universe: Gravitational Physics; Cosmology;
Nuclear Physics; Particle Astrophysics; Plasma Physics

Strongly-Interacting Systems: Nuclear Physics; Gravitational Physics;
Plasma Physics



Particle Physics at NSF

Support for Individual Investigators and Groups

Elementary Particle Physics – Experimental (Accelerator Based)

Jim Shank, Saul Gonzalez

Cosmic Phenomena – Jean Cottam

Studies of Ultra-High Energy Particles, CMB, Dark Energy

Underground Physics – Jim Whitmore

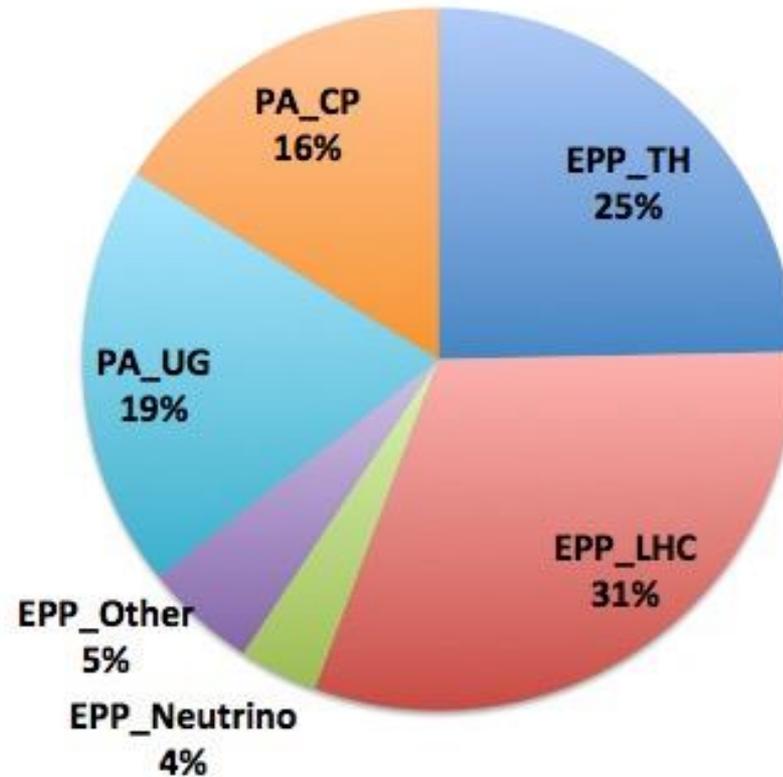
Experiments in environments requiring low background

Elementary Particle Physics and Astrophysics and Cosmology

Theory – Keith Dienes



PHY 2015 Individual Investigator Research Awards



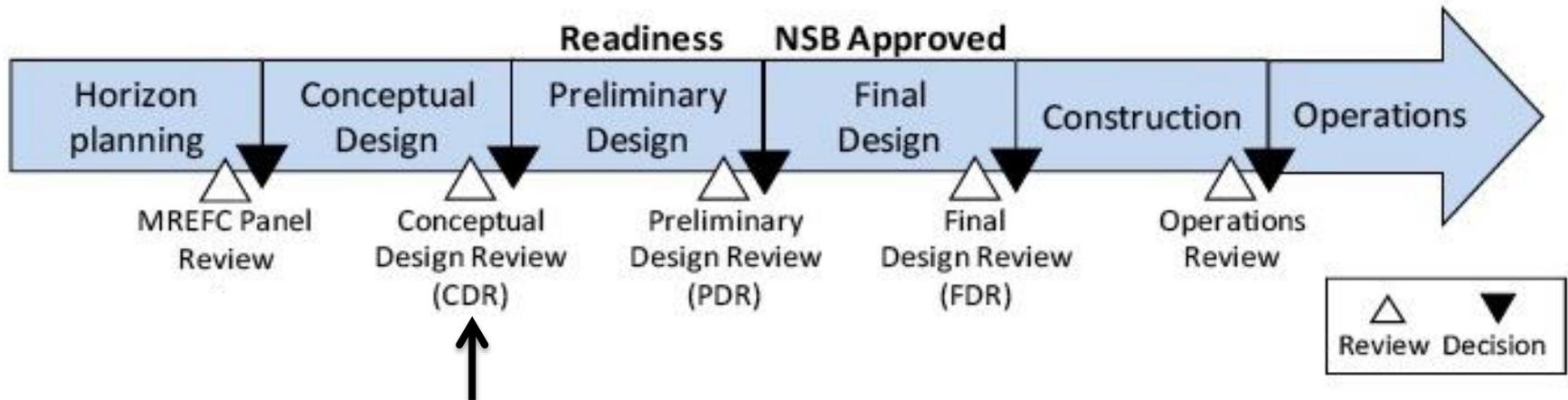
LHC M&O - \$18M/yr

IceCube M&O \$3.5M/yr – with Polar Programs



HL-LHC Upgrade

In response to P5, PHY initiated planning for a possible MREFC in support of the high-luminosity upgrades of the ATLAS and CMS detectors



Will come at a cost! All planning costs must come from R&RA funds.

Will impact program funding for all phases up to construction, if approved.



What to Look Out For in FY 2017

Revision of NSF 15-579 – Division-Wide Solicitation for Program Proposals
Will include additional details for submitting proposals requiring large-scale investments, including mid-scale

Physics Frontiers Centers Competition –
Pre-Proposals due August 2016 (tentative)

Opportunities offered by the National Strategic Computing Initiative (NSCI)



Computing and Cyberinfrastructure at NSF

Priority area of CIF21 (Cyberinfrastructure Framework for
21st Century Science, Engineering and Education)

Close collaboration with Division of Advanced Cyberinfrastructure (ACI)

Projects: OSG, DASPOS

Funding opportunity within Division:

- CDS&E (Computation and Data-Enabled Science and Engineering)

Funding opportunity led by ACI:

- SI2 (Software Infrastructure for Sustained Innovation)
- DIBBs (Data Infrastructure Building Blocks)

Opportunities to address NSCI, computing challenges facing the LHC

Contact Bogdan Mihaila with questions